

**EOARD contract FA8655-03-M4081**  
**"Digital Ionospheric Measurements in Greenland"**

**Progress and Final Report**

prepared by Jurgen Watermann, Senior Scientist  
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**I Technical Report**

The three digisondes located at the Greenland west coast sites, Narsarsuaq, Kangerlussuaq and Qaanaaq, have been operated according to the EOARD agreement. The acquired data were processed on site and stored as a sequence of one-day files on CD-ROM. The data were delivered via electronic communication links (internet connections) to AFRL. Backup copies of the data (CD-ROMs) were shipped to DMI where an archive of the records is kept.

A few small upgrades and replacements of minor components with spare parts received from AFRL resp. its subcontractor were performed. Otherwise the instruments were operated under routine supervision and with routine maintenance by on-site personnel. No substantial technical problems which would have resulted in loss or non-usability of recorded data were reported.

Verification of data quality and accuracy is ongoing. Comparison of plasma density profiles obtained with the digisonde and the incoherent scatter radar, colocated at the Sondrestrom Upper Atmosphere Research Facility, has shown good agreement between coincident data sets from the two different sensors.

**II Scientific Report**

The Danish small satellite "Ørsted" is since more than 5 years in space (initial design period 14 months), and its performance has somewhat degraded. Specifically the GPS occultation measurements have become less frequent and less usable. Further studies combining Ørsted GPS occultation and digisonde profiling measurements have therefore not been performed.

We received, however, Co-I status for scientific investigations with the data from the GPS package of the German CHAMP satellite. We further collaborate with the Applied Research Laboratories, University of Texas at Austin, on an ionospheric radio tomography experiment in southwest Greenland, with receiver stations, among others, at Narsarsuaq and Kangerlussuaq.

Investigations conducted so far have shown that F region plasma densities derived from the tomography array and the Sondrestrom incoherent scatter radar agree excellently under stable ionospheric conditions and less well under disturbed conditions (such as auroral substorms). E region densities have not yet been resolved satisfactorily with the tomography array. Since E region and bottomside F region are the prime domain of ionosondes we have here the possibility to resolve the full profiles, at least at the Narsarsuaq and Kangerlussuaq sites.

Studies involving ionospheric tomographic imaging and CHAMP GPS occultation profiling will continue with the involvement of the Greenland digisonde measurements.

signed: Jurgen Watermann 2004-09-01

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## REPORT DOCUMENTATION PAGE

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<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b>  This report results from a contract tasking Danish Meteorological Institute as follows: The Grantee will study the polar ionosphere and develop data to correlate variances of space and atmospheric electromagnetic transmission as well as operation of space and airborne systems. The contractor will use the existing US Government Furnished Digital Ionospheric Sounding System (DISS or three AN/FMQ-12 ionospheric sounders) in Qaanaaq 77o28'N 69o13'W, Sondre Stromfjord/Kangerlussuaq 66o55'N 51o07'W, and Narsarsuaq 61o20'N 45o21'W Greenland. These sounders have been delivered, installed, and operated under State Department MOU Ref No. 2000-12/DPC ref 512-148 titled 'Polar Cap and Auroral Ionospheric Dynamics - Satellite and Ground-Based Studies.' At the conclusion of this contract, all US Government Furnished Equipment will remain the property of the United States. DMI will provide the following resources and services: 1) Buildings and real estate suitable for the operation of the DISS and other ancillary equipment; 2) Electrical power, approximately 1kW, required by the DISS and other sensors; 3) Operate real time data networking and communications to provide regular, real-time updates as required by the Statement of Work; 4) Routine periodic maintenance according to the DISS Technical Orders; 5) Minor maintenance to receive and transmit antennas; 6) Change data recording media as required and mail to AFRL/VSBXI; 7) Assistance in diagnosing DISS failures by telephone, as required.; 8) Return shipment of defective components to AFRL/VSBXI; 9) Assist AFRL with logistics associated with major repairs, installations and infrastructure upgrades; 10) Provide AFRL/VSBXI personnel or other contractors access to site for major repairs or upgrade; 11) Analysis and quality control of the data obtained from the DISS and other sensors; 12) Provide copies upon request of any or all, raw or processed data gathered by the DISS in a form electronically compatible with AFRL/VS.					
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